

the literature of the subject. We do not find any reference to the underlying *assumption* which has up to the present been unearthed in every attempt to treat the problem mathematically. But this is hardly a point on which anyone but a specialist could be expected to light, and the majority of specialists make the assumption without knowing it (*pace* Burbury's criticisms).

The last chapter but one deals with the development of mathematical thought. We have selected for special examination the portions dealing with Cantor's researches on the transfinite and the continuum, and we find the subject treated in such a way as to present a clear and definite picture to one who has not specialised in this difficult branch of mathematical thought. The last chapter contains a retrospect and prospect.

We must not omit to mention what is, perhaps, as important a feature as any, namely, the footnotes, which occupy a considerable proportion of the whole book, and constitute a kind of historic encyclopædia.

We do not believe in filling reviews with lists of misprints, but the "Racket" (index, p. 800) may perhaps better describe Stephenson's locomotive than its correctly spelt name. A more serious defect is that these two large and bulky volumes have been issued with the pages uncut, and readers have to waste much time in doing what is the proper work of the guillotine before they can begin the book. This want of thought on the part of the publisher (on his own head be it—*i.e.*, the guillotine) constitutes a serious obstacle to the attempts made by scientific workers of the present day in endeavouring to cope with the ever-increasing mass of literature that accumulates before them.

G. H. BRYAN.

THE PROBLEMS OF VARIATION.

Variation in Animals and Plants. By H. M. Vernon, M.D. The International Scientific Series. Pp. ix + 415. (London: Kegan Paul and Co., Ltd., 1903.) Price 5s.

THIS little book meets a real want. The frequent discussions of recent years upon the problems of evolution have been followed with much interest by an increasing number of readers and listeners, with the desire but often the inability to understand. A very large amount of interest and stimulus has been excited by such questions as acquired characters and their transmission or non-transmission by heredity, the continuity of the germ-plasm, physiological selection, continuous or discontinuous evolution, De Vries's experiments and views on mutation, the Mendelian hypothesis as opposed to that of Galton and the bearing of the great array of facts, the fruits of observation and experiment conducted by those who take opposite sides in the controversy. The present writer has often been surprised at the keenness of the interest which can coexist with an almost complete lack of knowledge of the essential details, and he feels that the present work provides precisely the information that is required—a clear, accurate, and dispassionate statement, not too long or too detailed, of researches and reasoning upon problems connected with variation.

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The notable success of Section D during the late meeting of the British Association at Cambridge provides an excellent illustration of the wide and deep interest excited, at the present moment, by the last of the subjects mentioned above, and was in itself in some measure an answer to the complaint in the presidential address that insufficient attention was paid to the re-discovered discoveries of Mendel. The subject was new to probably a large proportion of the audience: those among them who had taken the opportunity of reading the fourth and fifth chapters (on blastogenic variation) of this work must have felt that they were thoroughly prepared to follow the discussion in all its detail.

The book is divided into three parts, of which the first, dealing with the *facts of variation*, contains three chapters, on the measurement of variation, dimorphism and discontinuous variation, and correlated variation respectively; the second, the *causes of variation*, includes two chapters on blastogenic variations, one on certain laws of variation, and four respectively treating of the effects of temperature and light, moisture and salinity, food and products of metabolism, and conditions of life in general; the third, *variation in its relation to evolution*, is considered in chapters on the action of natural selection on variation, and on adaptive variations.

The author wisely uses the word "hybridisation" very prominently in his account of Mendel's researches and conclusions. In the comparison between the Galtonian and Mendelian views of heredity an important difference is sometimes lost sight of—the present writer does not remember hearing it expressly mentioned, although it was certainly implied, at Cambridge. The former view is, at any rate chiefly, built upon the results of interbreeding between individuals separated by ordinary differences, the latter upon interbreeding between individuals separated by differences comparatively large. "Ordinary" differences are the points of distinction—generally small, mainly differences of degree—by which we discriminate between the individuals of a species forming a single compact mass, or if the species be broken up into two or more masses—then between the individuals within each of them. The larger differences alluded to are the points of distinction—generally large, frequently differences of kind—between the individuals of one mass ("species," "race," or "breed") and those of another, or between the ordinary individuals of a mass and those sudden large departures from its type which are apt to appear spontaneously in its midst. Even when breeds or races are distinguished by a test apparently so superficial and unimportant as colour, we are probably often confronted by the mere outward sign of inward and important distinction.

If the Mendelian view should hereafter be established beyond the possibility of doubt, there will still remain the interesting question of the part it has played in evolution. This is very largely the attempt to decide whether Darwin's earlier or later views were correct, whether evolution proceeds from the selection of large variations, "as when man selects," or from the selection of ordinary individual differences as

defined above. The question cannot be discussed on the present occasion, but it is well to bear in mind that however completely the *causes* of evolution in the past may evade our attempts at demonstrative proof, the *history* of evolution is a subject which can be brought to the test. For many years it has seemed to the writer that palaeontology can settle decisively whether evolution has been continuous or discontinuous. Those who desire to bring conclusive evidence to bear upon this important controversy would do well to follow the example of Prof. W. B. Scott, of Princeton, who told us at Cambridge that he was "just crazy" over the fossil mammals of Patagonia.

In the last chapter, on adaptive variations, the author would have done well to place in the forefront the warning that a superficially apparent example "of direct adaptation to surroundings in the ordinary acceptation of the term . . . may be the calling up, in response to one of two stimuli, of one of two groups of characters long since acquired by the plant protoplasm." The principle contained in these words should be prominently before the mind of the naturalist who attempts to investigate the response of an organism to its environment. He should remember that the species which he investigates are "heirs of all the ages," thoroughly inured to experimental research, past masters in the art of meeting by adaptive response the infinite variety of stimulus provided by the environment. If he remember this he will always be on his guard against a too hasty interpretation based upon the fundamental properties of protoplasm.

The discussion of the question, are acquired characters inherited? (pp. 351 *et seq.*) is a particularly interesting and suggestive introduction to the subject. A few well chosen examples of the evidence chiefly appealed to in support of such transmission are followed by a brief but well balanced discussion. The author supports the conclusion that the soma, and through the soma the environment, exert a chemical influence upon the germ-cells, and he makes effective use of the "internal secretions" which have marked an epoch in physiological research.

Several examples, generally believed to supply evidence of the "cumulative action of conditions of life" (pp. 352 *et seq.*), would be more satisfactory and convincing if they were re-investigated as a piece of special research. Too often they bear the impress of an off-hand opinion without any secure foundation upon specially directed inquiry. Thus, in the transport of adult sheep or dogs to a different climate, it may be expected that less change will be manifest in the hairy covering of the parent than in that of the offspring which has been born and passed the whole of its life in the new conditions. Thus the appearance, but by no means necessarily the reality, of an accumulated effect may be produced. In order to test the hypothesis of accumulation, it would be necessary to neglect the generation which has been subjected to two very different environments and to determine quantitatively with all possible accuracy the characters of those which follow. The often repeated statements about the teleonomic effect of mating "Lord Moreton's mare"

with a male quagga, when compared with the results of Prof. Cossar Ewart's researches, prepare us for the belief that many a general impression which has been produced as evidence will collapse when it has become the subject of searching and critical investigation.

In the preface the author speaks with some diffidence of the prominence given to his own researches. Investigations such as those into the effect upon offspring of the relative freshness or staleness of the parental germ-cells would, in any circumstances, be an unfortunate omission from a book on variation. They are, moreover, described in the publications of scientific societies not always freely accessible to the general reader. For another reason also the book would have suffered if these researches had been treated less fully. When the author of a general work is not altogether wanting in the sense of fitness and proportion, the account of his own contributions to science will probably be the salt of his book. These subjects stirred his own enthusiasm for research, and in writing of them he is likely to stir the enthusiasm of others.

E. B. P.

MATHEMATICAL THEORY OF ECLIPSES.

The Mathematical Theory of Eclipses, according to Chauvenet's Transformation of Bessel's Method. Explained and illustrated by Roberdeau Buchanan, S.B. Pp. x+247. (Philadelphia and London: J. B. Lippincott Co., 1904.) Price 31s. net.

WHEN a practical man devotes himself to the task of explaining to others the difficulties of any specialised subject on which he has been engaged for many years, the result is likely to be satisfactory. There is always the chance that the prolonged study of one particular subject has had the effect of unduly exalting its importance, with the consequent loss of a proper perspective, and when one sees a comparatively narrow branch of astronomical inquiry, like eclipses, occupying a rather ponderous volume, he may be led to think that the subject has been indiscreetly expanded. We therefore hasten to say that there is no evidence of disproportionate treatment in Mr. Buchanan's book. He himself has been employed for twenty-three years in the office of the "American Ephemeris and Nautical Almanac," and during that time has been responsible for the accurate preparation of the necessary information connected with eclipse prediction. His practical acquaintance with the subject eminently fits him for the task he has undertaken, and his book is a success. The moon's nodes have made more than one complete revolution since he began his work, and an entire series of eclipses has revealed to him their peculiarities and oddities.

The theory of eclipses has been well explained by various astronomers, and practical rules given by some. Hallaschka, in his "Elementa Eclipsium," following the method of orthographic projection, has worked out an example in full. Woolhouse, in the appendix to the "Nautical Almanac" for 1836, not only discussed the subject with great fulness, but gave practical rules for the determination of the phenomena, which for many years were followed in